

REMARKS

Claims 38-50 are pending in the application. In the Final Office Action of July 14, 2004, the Examiner made the following disposition:

- A.) Objected to claims 38-48 for informalities.
- B.) Rejected claims 47-48 under 35 U.S.C. §112, first paragraph.
- C.) Rejected claims 49-50 under 35 U.S.C. §112, second paragraph.
- D.) Rejected claims 38 and 48 under 35 U.S.C. §102(b) as being anticipated by *Isaka et al.*
- E.) Rejected claims 38, 41, 42, 45, 46, 49 and 50 under 35 U.S.C. §102(e) as being anticipated by *Xu et al.*
- F.) Rejected claims 39, 40, 43 and 44 under 35 U.S.C. §103(a) as being unpatentable over *Xu et al.*

Applicants respectfully traverse the rejections and address the Examiner's disposition below.

A.) Objected to claims 38-48 for informalities.

Claims 38-45 have been amended as per the Examiner's request to overcome the objection.

Claims 46-48 have been canceled.

Applicants respectfully submit the objection has been overcome and request that it be withdrawn.

B.) Rejected claims 47-48 under 35 U.S.C. §112, first paragraph.

Claims 47 and 48 have been canceled.

Applicants respectfully submit the rejection has been overcome and request that it be withdrawn.

C.) Rejected claims 49-50 under 35 U.S.C. §112, second paragraph.

Claim 49 has been amended as per the Examiner's request to overcome the rejection.

Claim 50 depends directly or indirectly from claim 49 and is therefore allowable for at least the same reasons that claim 49 is allowable.

Applicants respectfully submit the rejection has been overcome and request that it be withdrawn.

D.) Rejected claims 38 and 48 under 35 U.S.C. §102(b) as being anticipated by *Isaka et al.*

Applicants respectfully disagree with the rejection.

Claim 38, as amended, claims a display device comprising a semi-transparent reflective layer, a first electrode of a light reflecting material, a second electrode of a transparent material, and an organic layer including a light emitting layer interposed between the first electrode and the second electrode. A cavity portion comprises one of a gap between an interface between the first electrode and said organic layer and an interface between the organic layer and said semi-transparent reflective layer, a gap between an interface between the semi-transparent reflective layer and the second electrode and an upper edge interface of the second electrode, and a gap between an interface between the first electrode and said organic layer and said upper edge interface of the second electrode.

An optical path length L of the cavity portion has a positive minimum value in a range that satisfies the equation $(2L)/\lambda + \Phi/(2\pi) = m$ (m is an integer), where Φ radians is the sum of phase change amounts to reflection of the light emitted from the light emitting layer at both interfaces bounding the gap and λ is the peak wavelength of the spectrum extracted through said second electrode. As described in Applicants' specification, since the claimed optical path length of the cavity portion has the claimed positive minimum value, there is a reduced dependency on the viewing angle.

This is clearly unlike *Isaka*, which fails to disclose or even suggest Applicants' claimed optical path length. The Examiner argues that the passages from *Isaka* col. 5, line 44 and col. 6, lines 37-65 teach Applicants' claimed equation having the claimed positive minimum value, however, Applicants disagree. Nowhere in those passages from *Isaka* is there a teaching that *Isaka's* cavity portion has Applicants' claimed positive minimum value. Instead, those passages merely disclose an equation, which is not the same as Applicants' claimed equation, and a layer structure, with no explanation of Applicants' claimed positive minimum value. Referring to *Isaka* col. 6, lines 37-65, although the phase change at the time of reflecting by indium, by using

ITO for positive polarity and indium for negative polarity, is set to $\pi/2$, it differs because it is equal to Φ . This is because, by substituting $3/4\lambda$ from col. 6, line 63 into the equation at col. 5, line 44, $m = 1$ is obtained and the value of L at that time is not the positive minimum value as claimed in claim 38.

Thus, for at least these reasons, Applicants respectfully submit that *Isaka* fails to disclose or even suggest claim 38.

Claim 48 has been canceled.

Applicants respectfully submit the rejection has been overcome and request that it be withdrawn.

E.) Rejected claims 38, 41, 42, 45, 46, 49 and 50 under 35 U.S.C. §102(e) as being anticipated by *Xu et al.*

Applicants respectfully disagree with the rejection.

Regarding independent claim 38:

Claim 38, as amended, claims a display device comprising a semi-transparent reflective layer, a first electrode of a light reflecting material, a second electrode of a transparent material, and an organic layer including a light emitting layer interposed between the first electrode and the second electrode. A cavity portion comprises one of a gap between an interface between the first electrode and said organic layer and an interface between the organic layer and said semi-transparent reflective layer, a gap between an interface between the semi-transparent reflective layer and the second electrode and an upper edge interface of the second electrode, and a gap between an interface between the first electrode and said organic layer and said upper edge interface of the second electrode.

An optical path length L of the cavity portion has a positive minimum value in a range that satisfies the equation $(2L)/\lambda + \Phi/(2\pi) = m$ (m is an integer), where Φ radians is the sum of phase change amounts to reflection of the light emitted from the light emitting layer at both interfaces bounding the gap and λ is the peak wavelength of the spectrum extracted through said second electrode. As described in Applicants' specification, since the claimed optical path length

of the cavity portion has the claimed positive minimum value, there is a reduced dependency on the viewing angle.

This is clearly unlike *Xu*, which fails to disclose or even suggest Applicants' claimed optical path length. To begin with, *Xu* fails to even discuss Applicants' claimed equation relating to the claimed optical path length. Further, nowhere does *Xu* even discuss Applicants' claimed optical path length having a positive minimum value in a range that satisfies the claimed equation. Instead, *Xu* discloses a multi-mode microcavity 12, with no discussion relating to Applicants' claimed optical path length having a positive minimum value in a range that satisfies the claimed equation. As *Xu* fails to teach Applicants' claimed optical path length L having the claimed positive minimum value, *Xu* forces a large dependency on the viewing angle.

Accordingly, for at least this reason, *Xu* fails to disclose or even suggest claim 38.

Regarding independent claim 41:

Claim 41, as amended, claims a display device comprising a semi-transparent reflective layer, a first electrode of a light reflecting material, a second electrode of a transparent material, and an organic layer including a light emitting layer interposed between the first electrode and the second electrode. A cavity portion comprises one of a gap between an interface between the first electrode and said organic layer and an interface between the organic layer and said semi-transparent reflective layer, a gap between an interface between the semi-transparent reflective layer and the second electrode and an upper edge interface of the second electrode, and a gap between an interface between the first electrode and said organic layer and said upper edge interface of the second electrode. A color filter is provided for transmitting light resonating in the cavity portion and extracted through the second electrode. Reflectance of external light is limited to 30% or less.

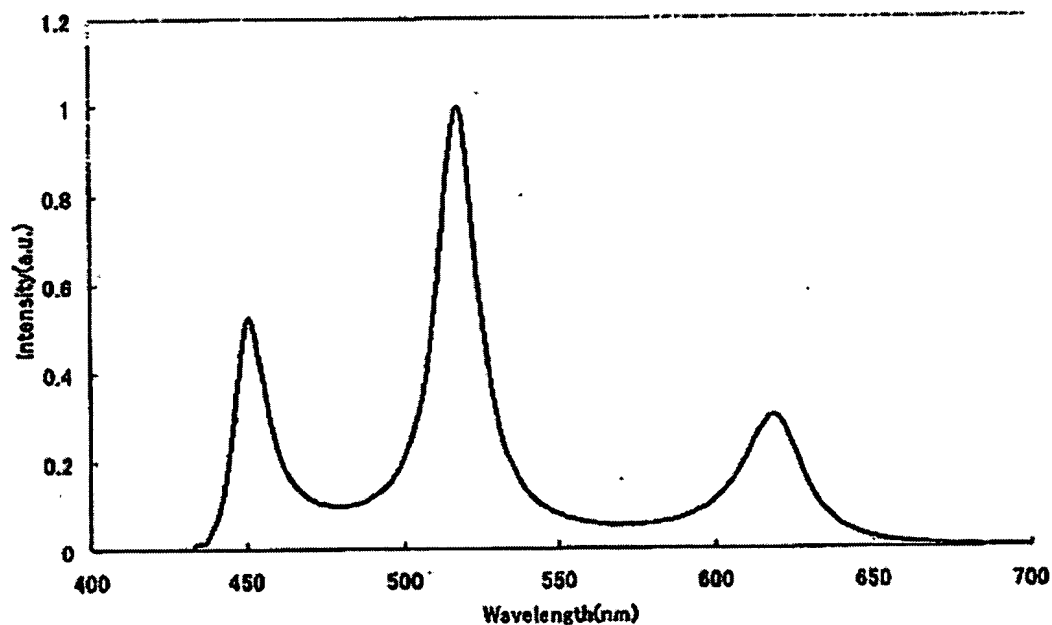
As shown in the illustrative examples of Applicants' Figures 20, 21 and 22, Applicants' reflectance reduces with the color filter. However, in *Xu's* multimode device, even if the device is covered with a color filter, the reflectance cannot be reduced, because the color filter is provided for separating colors not reducing reflectance. (See *Xu's* Figure 2). In *Xu*, a resonance cavity is used to present sharp peaks in RGB. The colors are separated through the use of color

filters. Such a method is known in the art as a multimode. Multimode does not address reducing reflectance, and *Xu* fails to even discuss decreasing reflectance. There is simply no teaching in *Xu* to limit reflectance of external light, let alone to Applicants' claimed value of 30% or less.

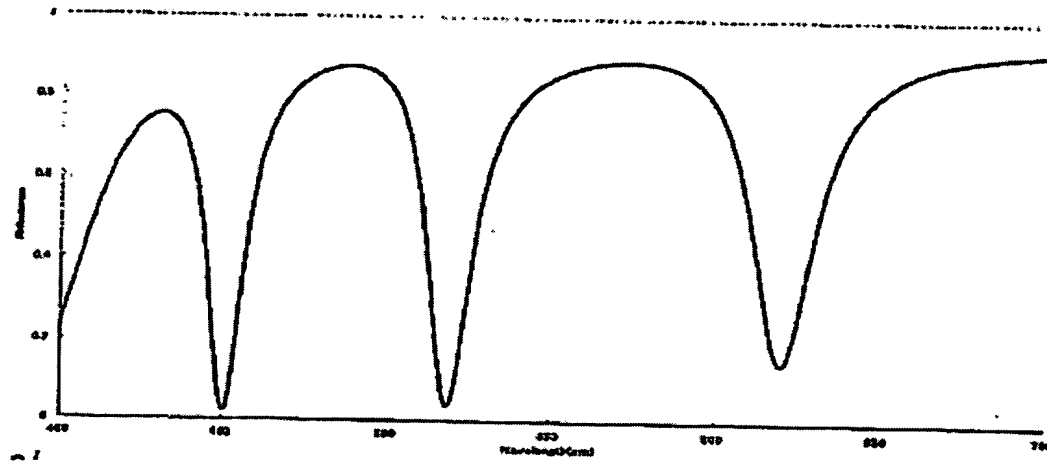
As evidence that *Xu* fails to remarkably reduce reflectance even with the use of a color filter, Applicants present a calculation of *Xu*'s reflectance below. The calculation is made using *Xu*'s structure:

glass substrate/Cr (200nm)/NPD (185nm)/light-emitting layer (30nm)/Alq3 (50nm)/ITO (450nm)/Mg (20nm)

The light-emission spectrum obtained by the calculations is shown below, which is similar to *Xu* Figure 2:

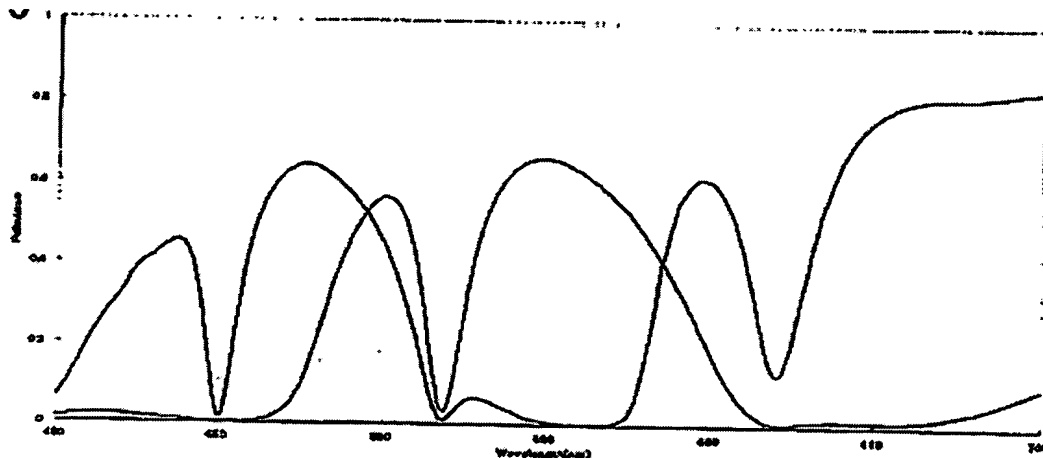


The reflection spectrum obtained by the calculations is shown below (with no color filter):



Applicants note *Xu's* calculated reflection spectrum is higher than the reflection spectrum presented in Applicants' Figure 20.

Further, *Xu's* reflectance obtained in the case where the color filter having the characteristics of Applicants' Figure 21 is used for RGB is shown below:



Thus, even in the region where *Xu's* color filters are used, *Xu's* reflectance is not remarkably reduced. As clearly shown in the above figure, *Xu's* reflectance has peak values between 0.4 and 0.8. This is much greater than Applicants' claimed reflectance that is limited to 30% or less. Thus, *Xu* fails to disclose or even suggest claim 41.

Regarding independent claim 49:

Claim 49, as amended, claims a display device, comprising a semi-transparent reflective layer, a first electrode of a light reflective material, a second electrode of a transparent material, and an organic layer including a light emitting layer interposed between the first electrode and the second electrode. A cavity portion comprises a gap between an interface between the first electrode and said organic layer and an interface between the organic layer and said semi-transparent reflective layer, and an optical path length of the cavity portion is limited to within one half of the half-width of the emission spectrum when the optical path length is the difference between the peak wavelength of the spectrum of light emitted by the device upon a change in view angle and the peak wavelength of the internal emission spectrum.

This is clearly unlike *Xu*, which fails to even discuss Applicants' claimed optical path length. Nowhere does *Xu* disclose or even suggest that its optical path length of its cavity portion is limited to within one half of the half-width of the emission spectrum when the optical path length is the difference between the peak wavelength of the spectrum of light emitted by the device upon a change in view angle and the peak wavelength of the internal emission spectrum. That subject matter is simply not even discussed in *Xu*. Therefore, for at least this reason, *Xu* fails to disclose or even suggest claim 49.

Regarding dependent claims 42, 45, 46 and 50:

Claims 42, 45, and 50 depend directly or indirectly from claims 38, 41 or 49 and are therefore allowable for at least the same reasons that claims 38, 41 and 49 are allowable.

Claims 46 has been canceled.

Applicants respectfully submit the rejection has been overcome and request that it be withdrawn.

F.) Rejected claims 39, 40, 43 and 44 under 35 U.S.C. §103(a) as being unpatentable over *Xu et al.*

Applicants respectfully disagree with the rejection.

Regarding claims 39 and 40:

Independent claim 39, as amended, claims an optical path length L' of ad cavity portion satisfies the equation $(2L')/\lambda + \Phi/(2\pi) = m1 + 4$ (m is an integer), where Φ radians is the sum of phase change amounts to reflection of the light emitted from the light emitting layer at both interfaces bounding the gap and λ is the peak wavelength of the spectrum of green light extracted through said second electrode, and an optical path length L of said cavity portion has a positive minimum value in a range that satisfies the equation and $m1$ is the integer m that satisfies the equation $(2L)/\lambda + \Phi/(2\pi) = m$ (m is an integer).

Independent claim 40, as amended, claims an optical path length L' of said cavity portion satisfies the equation $(2L')/\lambda + \Phi/(2\pi) = m1 + q$ (m is an integer), where Φ radians is the sum of phase change amounts to reflection of the light emitted from the light emitting layer at both interfaces bounding the gap and λ is the peak wavelength of the spectrum of green light extracted through said second electrode, and an optical path length L of said cavity portion has a positive minimum value in a range that satisfies the equation and $m1$ is the integer m that satisfies the equation and q is the integer not smaller than 10: $(2L)/\lambda + \Phi/(2\pi) = m$ (m is an integer).

This is clearly unlike *Xu*, which fails to disclose or even suggest Applicants' claimed optical path lengths. To begin with, *Xu* fails to even discuss Applicants' claimed equations relating to the claimed optical path length. Further, nowhere does *Xu* even discuss Applicants' claimed optical path length having a positive minimum value in a range that satisfies the claimed equation. Instead, *Xu* discloses a multi-mode microcavity 12, with no discussion relating to Applicants' claimed optical path length having a positive minimum value in a range that satisfies the claimed equation. As *Xu* fails to teach Applicants' claimed optical path length L having the claimed positive minimum value, *Xu* forces a larger dependency on the viewing angle.

Further, with respect to claim 40, as discussed in Applicants' specification, when m is set to a high value, a change in chromaticity can be suppressed. *Xu* fails to even discuss setting a

parameter in its equation to suppress a change in chromaticity. Therefore, for at least this additional reason, *Xu* fails to disclose or suggest claim 40.

Accordingly, for at least this reason, *Xu* fails to disclose or even suggest claims 39 and 40.

Regarding claims 43 and 44:

Claims 43 and 44 depend directly or indirectly from claim 41 and are therefore allowable for at least the same reasons that claim 41 is allowable.

Applicants respectfully submit the rejection has been overcome and request that it be withdrawn.

Conclusion

Claims 51 and 52 are newly added. In view of the above amendments and remarks, Applicants submit that all of claims 38-45 and 49-52 are clearly allowable over the cited prior art, and respectfully request early and favorable notification to that effect.

Respectfully submitted,

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